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**COMPREHENSIVE, MULTI-DIMENSIONAL GRAPHICAL USER
INTERFACE USING PICTURE METADATA FOR NAVIGATING AND
RETRIEVING PICTURES IN A PICTURE DATABASE**

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**COMPREHENSIVE, MULTI-DIMENSIONAL GRAPHICAL USER
INTERFACE USING PICTURE METADATA FOR NAVIGATING AND
RETRIEVING PICTURES IN A PICTURE DATABASE**

FIELD OF THE INVENTION

The present invention relates to graphical user interfaces in general, and in particular to graphical user interfaces adapted for browsing and retrieving pictures in digital picture databases.

BACKGROUND OF THE INVENTION

Digital pictures and digital picture albums/collections are proliferating with recent advances in quality and cost reductions. Digital pictures can be stored in common or individual databases that allow a user to retrieve his or her pictures for viewing and reproduction via a computer system. When a large number of pictures are stored in a collection, it is desirable to be able to browse and retrieve selected pictures with a graphical user interface (GUI). Used for such an application, a GUI conveniently organizes and groups database pictures, and allows a user to browse the pictures in one or more displays.

Along with the digital information representing pictures, digital image files can also contain metadata, or information not displayed, which nonetheless characterizes the data comprising the pictures. The metadata can describe the scene in the picture, such as a caption, and can also provide in a straightforward manner, information such as the date and time the picture was captured, the location from which the picture was captured, identify people or objects in the picture, and information regarding format and data structure.

Many prior art digital cameras can be programmed to automatically store along with the actual image, the date and time a picture was captured. More advanced digital cameras can also be programmed to automatically store along with the actual image, the location of picture capture by harnessing automatic location systems. For example, the Global Positioning Satellite (GPS) is a well-known method for pinpointing the location of a special GPS receiver with a fairly high degree of accuracy. Other methods include the use of Radio Triangulation (RT) systems. Using such an approach, a GPS receiver can be either incorporated

in the hardware of the digital camera, or located nearby. A subsequent image file will contain not only the raw image data, but also a date and time stamp, along with header information related to the location of the GPS receiver when the image is collected.

5 Still more advanced digital cameras may contain pattern recognition software for identifying objects and people in an image, and converting such information to metadata.

Whether metadata is entered automatically by the camera, manually via the camera during picture captures, or subsequently into the digital image database, there remains a great need for improved GUIs for efficiently and attractively arranging pictures in a digital image database.

10 A number of recently introduced GUIs provide picture database users with different methods for navigating and retrieving database pictures. Some navigation methods may work better than others, depending on the circumstances. It would therefore be desirable to give a picture database user the option to use multiple navigation methods for a more robust system. It would also be desirable to conveniently link the different navigation methods in a user-friendly way.

More particularly, there is a great unmet need to provide a comprehensive graphical user interface for browsing and retrieving pictures in a digital picture database, which incorporates multiple methods of picture navigation, and in which displays corresponding to said multiple picture navigation methods are accessible via a linked, user-friendly main display level.

25 SUMMARY OF THE INVENTION

To address the unmet needs of the prior art identified *supra*, the present invention provides a graphical user interface (GUI) adapted to browse pictures stored in a picture database. The GUI at least includes a main level display and a plurality of display levels linked to the main display level via one or more icons in the main display level. The main display level provides links to the other display levels, and at least includes: a hierarchical picture grouping iconic region indicating directories, folders and files containing pictures from the data-

base; at least one main display area adapted to at least display pictures, thumbnails and graphical browsers; a picture content iconic region, at least including icons representing pictures in the picture database according to predefined content categories and picture metadata; and a graphical browser region, at least including indicia of graphical browsers utilized by the GUI.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the present invention will become apparent to those skilled in the art from the description below, with reference to the following drawing figures, in which:

Figure 1 is an example of the main display level/screen of the graphical user interface (GUI) of the present invention;

Figure 2 is an example of a second display level of the present invention, highlighting a hierarchical picture grouping iconic region indicating directories, folders and files containing pictures from a picture database, and including thumbnails of pictures in the database;

Figure 3 is an example of a second display level of the present invention, highlighting a picture content iconic region, at least including icons representing pictures in the picture database according to predefined content categories and picture metadata;

Figure 4 is an example of a display level linked to the display level of Figure 3, with thumbnails of pictures in the picture database captured in a selected year;

Figure 5 is an example of a second display level of the present invention, in general, highlighting a graphical browser region, at least including indicia of graphical browsers utilized by the GUI, and including an example of a geographic map browser in particular; and

Figure 6 is an example of a second display level of the present invention, in general, highlighting a graphical browser region, at least including indicia of graphical browsers utilized by the GUI, and including an example of a scatter plot browser in particular.

DETAILED DESCRIPTION OF THE INVENTION

As will be described below in more detail, the present invention
novelly provides a multi-dimensional graphical user interface (GUI) which uses a
comprehensive primary/main display level linked to a number of secon-
5 dary/second display levels. The main display level gives the user broad picture
navigation capabilities using several methods of picture navigation that are novel
in their own right. Icons in the main display can be activated to link to a second
display level utilizing navigation methods identified in the main display level.

The main display or main display level 100 in Figure 1 shows the
10 comprehensive navigation capability of the present-inventive GUI. There is a
main display area 102, along with four navigation method areas 104, 106, 108 and
110. The main display level 100 also includes other features, such as an “exit”
button 112 to exit the main level display (and GUI) when desired, a thumbnail ex-
planation area 114 for displaying particular details about thumbnails of pictures
15 displayed in the display area 102, as well as an information box 116.

Although the information box is a matter of design choice, the pre-
ferred embodiment includes an area 118 for specific information about pictures
identified, and a comment area 120 for comments previously stored by a user, or
derived from picture metadata. The display can be in the form of a full view by
20 activating the “full view” button 124, or in the form of an annotation view by acti-
vating the “annotation” button 122.

The user can access pictures in the picture database by activating
one of the four regions 104-110. The region 104 labeled “My Organization” is a
hierarchical picture grouping iconic region indicating directories, folders and files
25 containing pictures from the database. Using this region, the user simply opens
directories, folders, files, etc. of interest to retrieve pictures. An example of a sec-
ondary/second display level appears in Figure 2, where the user has opened a
folder (labeled “Baby Joey”) and has displayed the thumbnails of the pictures in
that folder in the display area 102. The information box 116 has information de-
30 rived from picture metadata about the pictures in the folder. The thumbnail ex-
planation box 114 has metadata-derived information about the particular thumb-
nail highlighted (Image 1 of 9 in the example).

Instead of browsing individual directories, folders, files and the like, the user may desire to activate the "Picture Content Categories" region (or picture content iconic region) 106. That region has icons representing pictures in the picture database according to predefined content categories and picture meta-
5 data (See Figure 3). In the example of Figure 5, the user has decided to view pictures according to the "Date" category. The display area 102 shows that for the chosen year (1999), there are ten pictures in the picture database. The information box contains information derived from the picture metadata about the pictures in this particular year, such as that the subject of the pictures is "Adam," that he was
10 a one-year-old when the pictures were captured in Massachusetts, and that he is playing with his favorite toy. It is readily apparent from Figure 3, that many other picture content categories are possible.

Figures 5 and 6 are illustrative of a user activating the "Graphical Browser" iconic region 108 to choose to browse the picture database with specific
15 browsing methods utilized by the GUI, which methods may be inventive in their own right. In the example of Figure 5, the user has chosen a geographic map browser with icons (not shown) located at picture capture locations on a map such as a picture of a globe (in the display area 102). Activating an icon produces another display with thumbnails of the pictures captured at the particular location
20 represented by the icon.

In the example of Figure 6, the user has chosen a three-dimensional scatter plot browser with icons, and with first and second axes representing separate category information, and the third dimension being determined by the visual nature of the icons, and representing a third category of information. It is readily
25 apparent from Figures 5 and 6 that other graphical browsers can be used with the present invention.

A user can choose to navigate the pictures in the picture database by activating the "Search" region 110 of the present-inventive GUI. This permits the user to use Boolean searches and other advanced word-search methods avail-
30 able in the present-inventive GUI.

[illegible]

Variable	Mean	Standard deviation	Minimum	Maximum
Age	34.5	10.2	22	55
Gender	0.5	0.5	0	1
Marital status	0.7	0.5	0	1
Education	12.5	1.5	10	15
Income	1500	500	1000	2500
Health status	0.8	0.4	0	1
Smoking status	0.3	0.5	0	1
Alcohol consumption	0.2	0.4	0	1
Exercise frequency	0.5	0.5	0	1
Stress level	0.6	0.5	0	1
Depression score	0.4	0.5	0	1
Life satisfaction	0.7	0.5	0	1
Overall health	0.8	0.4	0	1